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ABSTRACT

To cope with some social problems, Japanese educational planners are drafting some proposals for research into innovations in the educational system. This paper reports on some research recently done which looked into the relationships of the Japanese educational environment and the reasoning/thinking skills and process skills of students in science. Following a discussion of the different variables investigated, a number of positive correlations are reported. These include findings on very distinct relationships between: (1) measures of students logical thinking and science process skills; (2) students' extent of participation in science activities and their extent of participation in scientific investigation; (3) students' attitudes and their extent of participation in scientific investigation; (4) students' extent of participation in investigation and their feelings about nature; (5) students' attitudes and their extent of participation in science activities; and (6) students' extent of participation in scientific investigation and the measures of their science process skills. (TW)

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Implications of the Educational Environment and Its Correlation to the Reasoning/Thinking Skills and Process Skills of Learners in Japan

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Implications of the Educational Environment and Its Correlation to the Reasoning/Thinking Skills and Process Skills of Learners in Japan

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To cope with some social problems, Japanese education planners are presently drafting some proposals for innovating our educational system. The outcome of this joint research would certainly be a significant issue.

Before implications are made on the relationship between the students' educational environment and their measures of logical thinking and science process skills, may I first give you a brief discussion of our panel's implications on the students' educational environment as a result of this research.

As can be noted from the teachers' questionnaire, textbooks were frequently used as teaching aids, with materials and equipment ranking second. Textbooks are indispensable teaching materials not only in science but in other subjects as well. Along with these are the latest and most modern science materials and equipment designed to create an entirely thought-provoking atmosphere for the science students.

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The lecture method and discussion were most frequently used in the teaching-learning activity with the laboratory method ranking second. Moreover, teaching and learning take place frequently in the laboratory. To be able to interpret these facts, let me give you the general objectives of the junior high school science curriculum. It is aimed at "developing the ability in and positive attitude toward making inquiries about nature through observations and experiments as well as to enhance the students' understanding of matters and phenomena in nature. Thus to have the students realize the relationship between nature and human beings." This objective specifically deals with the cognitive, affective and psychomotor aspects of the students' development. To be able to carry out this objective, the science teacher employs a combination of lecture/discussion and laboratory methods. However, experimentation and other related activities are usually characterized by an authoritarian atmosphere wherein the science teacher usually does not give complete freedom to the students to perform experiments. This is partly due to some experimental hazards which the science teacher wants to prevent and also partly due to the typical attitude of a Japanese teacher to impose strict discipline in class. Discussion is a crucial part of every science activity. For example, planning out and designing an experiment involves student discussion. Apart from this, students discuss experimental results and observations thereby training them to reason logically. Drawing conclusions and generalizations from experimental results is always

encouraged. So, it is perhaps safe to say that a combination of authoritarian and exploratory methods are evident in the junior high school science curriculum.

Paper and pencil tests were frequently used as a method of evaluation. Observation was sometimes used in evaluation to help students gain further understanding of science, and ranks second. The fact that these areas were close to each other in rank shows that a combination of the three was found by the teacher to be very useful in evaluating learning outcomes.

In-service training programs and workshops at the prefectural level were attended by 85.3% of the teachers. However, only 29.4% of them have attended related in-service training programs in the state or national level in the last three years. This is due to the fact that most in-service training programs for teachers are arranged by prefectural education planners and supervisors. Only very limited programs are planned in the state or national level.

The category of the reading of science literature and science education literature yielded a very low percentage. 45.5% of the subject teachers read science literature and 40% rarely read science education literature. This can only be interpreted in line with the science teachers' lack of interest to grow professionally which should be enlightened through discussions during in-service training.

An inventory of the students' out-of-school activities yielded a 38.88% participation which is fairly low. Involvement in school club activities is one reason for this. Students spend some hours before and after their regular class hours to

attend to club activities. In some cases, they even have to come on Sundays for related activities. Another reason is the fact that a student's study requires hard work and diligence. The disciplinarian teacher never tolerates a student coming to class unprepared for the day's lesson. So it can be seen from this that the science student is too busy to attend to out-of-school activities.

However, the Scientific Investigation Questionnaire yielded a higher participation rate of 55.39%. This implies that the students were more inclined to exploratory activities individually or by a group. As can be noted "cooperation with other students" was the number one favored response and second to it was "working patiently through an investigation until he can arrive at a solution."

More importantly is the Science Attitude Scale which yielded a mean of 64.45. Although this implies a generally positive attitude, this result is quite low from what we expected. An implication for this is the authoritarian atmosphere in classes and the way some of the students' freedoms are suppressed by the authoritarian teacher. This result is very significant for us in designing the style of a new science program.

An evaluation of the students' emotion about natural phenomena indicated a high degree of 79.1. The traditional Japanese concept of love of nature has something to do with this. Most parents encourage their children to have pets and grow plants at home, an indication of an innate love for nature.

So far, I have discussed with you the different variables on the students' measures of logical thinking and science process skills which is the "students' educational environment." Let me now move on to the result of the GALT Test which was used to measure the students' thinking skills level. The test results yielded a remarkably high over-all mean of 50.1. Among the five phases used, combinational reasoning ranked number one while conservation ranked number two among the items correctly answered by the students. In line with this, the measure of their thinking skills is as follows:

concrete- 31.83%

transitional- 36.45%

formal-31.72%

As can be seen, almost 70% of the students have reached the transitional and formal level of thinking which is typical of their age. Although the junior high school educational environment has a direct bearing on this test result, the elementary science and arithmetic school program also has something to do with it. The elementary child is exposed to various activities as preparatory training on reasoning skills in arithmetic and science. Although they may be simple activities, they involve the five phases of logical thinking skills. Most particularly combinational reasoning and conversation.

The TIPS Test which was used to measure the students' process skills yielded a higher over-all mean of 60. More credit can be given to the elementary science curriculum. Of

course, the students' present educational environment cannot be overlooked for it has a direct bearing on the result. Yet, the foundation of the students' process skills is in the elementary level, the teaching method of which is purely exploratory and uses the process approach. It is sufficient to say that the students were familiar with the GALT and TIPS Tests, having had enough similar exercises both in the elementary and junior high school.

Finally, let me present to you the following correlation coefficients for the research questions. As you can see, all the correlations are significant. There was a very distinct relationship between:

a. measures students' logical thinking and science process skills.

b. students' extent of participation in science activities and their extent of participation in scientific investigation.

c. students' attitude and their extent of participation in scientific investigation

d. students' extent of participation in scientific investigation and their emotion about nature

e. students' attitude and their extent of participation in science activities

f. students' extent of participation in scientific investigation and the measures of their science process skills.

A less distinct relationship can be noted between:

a. students' extent of participation in scientific investigation and the measures of their logical thinking skills

b. students' extent of participation in science activities and their emotion about nature

c. students' attitude and the measures of their science process skills

d. the students' emotion about nature and the measures of their science process skills

e. students' attitude and the measures of their logical thinking skills

f. students' attitude and their emotion about nature.

The least distinct relationship can be noted between:

a. the students' emotion about nature and the measures of their logical thinking skills

b. the students' extent of participation in science activities and the measures of their science process skills

c. the students' extent of participation in science activities and measures of their logical thinking skills.

To conclude: as all the correlations are statistically significant, it can be implied that all the variables in the students' educational environment have a relationship on the measures of their logical thinking and science process skills. The relationship between variables however, vary in

distinctiveness. Hence, the sum total of the students' educational evnironment determines the mesures of his logical thinking and science process skills. How to structure an educational environment which is typically conducive to the development of logical thinking and acquisition of science process skills, is for us science educators, a very important task.

Let me emphasize the importance of logical thinking and reasoning by the following meaningful lines from Blaise Pascal:

"All our dignity lies in thought. By thought we must elevate ourselves, not by space and time which we cannot fill. Let us endeavor then to think well; therein lies the principle of morality."

Thank you very much and good day to all of you.

Table 1 CORRELATION COEFFICIENTS FOR RESEARCH QUESTIONS

INSTRUMENTS	TOTAL	GRADES 7th	8th	9th
GALT : TIPS	.638	.621	.599	.655
ACTIVITIES: SCIENTIFIC INVESTIGATION	.470	.515	.480	.429
ATTITUDE: SCIENTIFIC INVESTIGATION	.435	.459	.430	.418
SCIENTIFIC INVEST. :EMOTION	.420	.427	.450	.349
ATTITUDE: ACTIVITIES	.374	.380	.338	.370
SCIENTIFIC INVEST. :TIPS	.346	.289	.403	.361
SCIENTIFIC INVEST. :GALT	.281	.254	.284	.324
ACTIVITIES: EMOTION	.271	.303	.293	.242
ATTITUDE: TIPS	.250	.270	.277	.262
EMOTION: TIPS	.225	.204	.265	.178
ATTITUDE: GALT	.220	.220	.253	.257
ATTITUDE: EMOTION	.200	.209	.200	.195
EMOTION: GALT	.161	.136	.174	.150
ACTIVITIES: TIPS	.091	.098	.142	.143
ACTIVITIES: GALT	.081	.106	.113	.134

ALL CORRELATIONS WERE SIGNIFICANT (P < .05)